I. *An Account of the Experiments made by ſome Gentlemen of the* Royal Society, *in order to meaſure the abſolute Velocity of* Electricity; *communicated to the* Royal Society *by Mr.* W. Watſon *F.R.S.*

Read Oct. 27. 1748. I LAID before the *Royal Society* the Beginning of laſt Winter an Account * of what had been done by ſome Gentlemen, in order to aſcertain the reſpective Velocities of Electricity and Sound; from which it appeared, that through a Space meaſuring 6732 Feet, the Electricity was perceptible in a Quantity of Time leſs than $\frac{837}{1000}$ of a Second. But the Gentlemen concerned were deſirous, if poſſible, of aſcertaining the abſolute Velocity of Electricity at a certain Diſtance; and a Method had been thought of, by which this might be determined with great Exactneſs.

Accordingly, *Auguſt* 5. 1748. there met at *Shooter's Hill* for this Purpoſe, the *Preſident* of the *Royal Society*, the Rev. Mr. *Birch*, the Rev. Dr. *Bradley*, Aſtronomer Royal, *James Burrow* Eſq; Mr. *Ellicot*, Mr. *George Graham*, *Richard Graham* Eſq; the Rev. Mr. *Lawrie*, *Charles Stanhope* Eſq; and myſelf, who were of the *Royal Society*, Dr. *Bevis*, and Mr. *Griſchow* jun. a Member of the *Royal Academy* of *Sciences* at *Berlin*.

It was agreed to make the electrical Circuit of two Miles; in the middle of which an Obſerver was to take in each Hand one of the Extremities of

* See theſe *Tranſ.* N°. 485.

a Wire, which was a Mile in Length. Theſe Wires were to be ſo diſpoſed, that this Obſerver being placed upon the Floor of the Room near the electrical Machine, the other Obſervers might be able in the ſame View to ſee the Exploſion of the charged Phial, and the Obſerver holding the Wires; and might take notice of the Time lapſed between the diſcharging the Phial and the convulſive Motions of the Arms of the Obſerver in conſequence thereof; inaſmuch as this Time would ſhew the Velocity of Electricity, through a Space equal to the Length of the Wire between the coated Phial and this Obſerver.

The electrifying Machine was placed in the ſame Houſe as it was laſt Year. We then found ourſelves greatly embaraſſed by the Wire's being conducted by the Side of the Road, which we were compell'd to, on account of the Space neceſſary for the meaſuring of Sound: But ſo great a Diſtance from the Machine was not now wanted, though the Circuit through the Wire was intended to be at leaſt two Miles. We had diſcover'd, by our former Experiments, that the only Caution now neceſſary was, that the Wires conducted upon dry Sticks ſhould not touch the Ground, each other, or any Non-electric, in a conſiderable Degree, in any Part of their Length: If they did not touch each other, the Returns of the Wire, be they ever ſo frequent, imported little, as the Wire had been found to conduct Electricity ſo much better than the Sticks. It was therefore thought proper to place theſe Sticks in a Field fifty Yards diſtant from the Machine. The Length of this Field being eleven Chains, or 726 Feet, eight Returns of the Wire from the Top

to

to the Bottom of the Field, made ſomewhat more than a Mile, and ſixteen Returns more than two Miles, the Quantity of Wire intended for the Electricity to paſs through to make the Experiment.

We had found laſt Year, that, upon diſcharging the electrified Phials, if two Obſervers made their Bodies Part of the Circuit, one of which graſped the leaden Coating of the Phial in one Hand, and held in his other one Extremity of the conducting Wire; and if the other Obſerver held the other Extremity of the conducting Wire in one Hand, and took in his other the ſhort iron Rod with which the Exploſion was made; upon this Exploſion, I ſay, they were both ſhocked in the ſame Inſtant, which was that of the Exploſion of the Phial. If therefore an Obſerver, making his Body Part of the Circuit, was ſhocked in the Inſtant of the Exploſion of the charged Phial in the middle of the Wire, no Doubt would remain of the Velocity of Electricity being inſtantaneous through the Length of that whole Wire. But if, on the contrary, the Time between making the Exploſion, and ſeeing the Convulſions in the Arms of the Obſerver holding the conducting Wires, was great enough to be meaſured, we then ſhould be able to aſcertain its Velocity to the Diſtance equal to half the Quantity of Wire employed only, let the Manner of the Electricity's diſcharging itſelf be what it would.

It has been a Queſtion with ſome, who have conſider'd this Subject, whether the Electricity, in compleating the Circuit from the Matter contained in the Glaſs, paſſed either by the Wire in the Mouth to the Coating of the Glaſs, the contrary Way by

the Coating to the Wire in the Mouth, or otherwiſe directed itſelf both Ways at once? That the Electricity muſt paſs off one of theſe three Ways, was certain, as the Exploſion would not be complete, unleſs in the Inſtant thereof ſome Matter very non-electric communicated between the Wire in the Mouth, and the Coating of the Glaſs. Unleſs therefore the Obſerver was placed in the Centre of the conducting Wires, it might be objected, that the Experiment was not made with the Exactneſs neceſſary; becauſe any Perſon, who was of Opinion that the Electricity directed itſelf from the Mouth of the Glaſs to the Coating, might object, if the Wire from the ſhort iron Rod to the Obſerver was only half the Length of that between the Obſerver and the Coating of the Glaſs, that the Electricity, in the Time found, paſſed only through the ſhort Wire, and *vice verſa*. But if, as it was here thought proper, the Obſerver was placed in the Centre of the conducting Wire, let the Direction of the Electricity be what it would, no Difference could happen in the Reſult of the Experiments, if made with the neceſſary Caution; becauſe, if the Effects in the middle and both Ends of the Wires were inſtantaneous, the Concluſion therefrom would be very obvious. To make the Experiment, the ſame Phial filled with Filings of Iron, and coated with Sheet-Lead, which was uſed laſt Year, was placed in the Window of the Room near the Machine, and was connected to the prime Conductor by a Piece of Wire. To the Coating of this Phial a Wire was faſtened; which, being conducted upon dry Sticks to the before-mentioned Field, was carried in like manner to the Bottom;

tom; and being conducted thus from the Bottom of the Field to the Top, and from the Top to the Bottom ſeven other times, returned again into the Room and was held in one Hand of an Obſerver near the Machine. From the other Hand of this Obſerver, another Wire, of the ſame Length with the former, was conducted in the ſame manner, and returned into the Room, and was faſten'd to the iron Rod with which the Exploſion was made. The whole Length of the Wires, allowing ten Yards for their Turns round the Sticks, amounted to two Miles a Quarter and ſix Chains, or 12276 Feet.

As the Night preceding theſe Experiments had been very rainy, Care was taken, by ſilk Lines properly diſpoſed, that the Wires in their Paſſage from the Window of the Houſe might not touch the Wood thereof; leſt, from the Moiſture of this Wood, the electrical Circuit might be ſhortened.

When all Parts of the Apparatus were properly diſpoſed, ſeveral Exploſions of the charged Phial were made; and it was invariably ſeen, that the Obſerver holding in each Hand one of the Extremities of theſe Wires was convulſed in both his Arms in the Inſtant of making the Exploſions.

Inſtead of one, four Men were then placed holding each other by the Hand near the Machine, the firſt of which held in his right Hand one Extremity of the Wire, and the laſt Man the other in his left. They were all ſeen convulſed in the Inſtant of the Exploſion. Every one who felt it, complained of the Severity of the Shock.

It was then deſired, by one of the Gentlemen concerned, that an Exploſion ſhould be made with the Obſerver holding only one of the Wires. This

was done accordingly; but the Obſerver felt nothing, the Phial diſcharging itſelf in a different manner to what it did before, on account of the Circuit's not being compleated.

It was then tried, whether an Obſerver would be ſhocked upon the Diſcharge of the Phial, if the two Wires at their Extremities ſlightly touched each other, whilſt an Obſerver at the ſame time held one of theſe about a Foot from their Ends in each of his Hands. Upon Trial he felt nothing, though the Phial exploded very quick, becauſe the iron Wire conducted the Electricity better than the Body of the Obſerver.

It was then tried, whether or no, as the Ground was wet, if the Exploſion was made with the Obſerver holding the Extremity of each Wire ſtanding upon the Ground near the Window of the Houſe, any Difference would ariſe in the Succeſs of the Experiment. No Difference was found, the Obſerver being ſhocked in the Inſtant of the Exploſion, as before, in both his Arms, and acroſs his Breaſt.

Upon theſe Conſiderations we were fully ſatisfied, that through the whole Length of this Wire, being, as I mentioned before, twelve thouſand two hundred and ſeventy-ſix Feet, the Velocity of Electricity was inſtantaneous.

As it was found laſt Year, we obſerved again, that although the electrical Commotions were very ſevere to thoſe who held the Wires, the Report of the Exploſion at the prime Conductor was little, in compariſon of that which is heard when the Circuit is ſhort. From whence it was conjectured, that the very loud Report, in the Experiment of *Leyden* is confined to a very ſhort Circuit.